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Proposals for amendments to RID/ADR/ADN: pending issues

Periodic inspection and test of some transportable refillable LPG steel cylinders in RID/ADR

Transmitted by the European Liquefied Petroleum Gas Association (AEGPL)[1, 2]

[1] In accordance with the programme of work of the Inland Transport Committee for 2012–2016 (ECE/TRANS/224, para. 94, ECE/TRANS/2012/12, programme activity 02.7 (A1c)).

[2] Circulated by the Intergovernmental Organisation for International Carriage by Rail (OTIF) under the symbol OTIF/RID/RC/2014/31.

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Summary

Executive summary:	Introduce into RID/ADR the possibility of using a specific procedure for periodic inspection and testing of over-moulded liquefied petroleum gas (LPG) cylinders.
Action to be taken:	To add a definition in 1.2.1, a clause 6.2.1.1.10 , a clause 6.2.3.5.3 and 6.2.3.5.4 and a new item in packing instruction P200 in 4.1.4.1. To remove the exclusion of annex G for EN 1440:2008 + A1 :2012 in table in clause 6.2.4.2 and the exclusion of annex G for EN 1439 :2008 in the table in item 11) of P200.
Related documents:	Informal document INF.50 submitted by AEGPL and Informal document INF.45 submitted by Germany at the autumn 2013 session; ECE/TRANS/WP.15/AC.1/2013/43 and its informal document INF. 6; Informal document INF.39 submitted at the spring 2013 session; ECE/TRANS/WP.15/AC.1/2013/16; Multilateral agreement M247; prEN 1440 (WI 00286156), LPG equipment and accessories - Transportable refillable LPG cylinders other than welded and brazed steel cylinders: periodic inspection; EN 1440:2008 + A1:2012, LPG equipment and accessories. Periodic inspection of transportable refillable LPG cylinders.

General

1. Over-moulded cylinders have been manufactured since 1997 and the quantity of cylinders manufactured is over 3.6 million. They are in commercial use in at least two European countries (France and Belgium) for carriage of LPG. The welded steel inner pressure receptacle is coated (painted) as a protection against external corrosion. The protective case in cellular plastic material is over-moulded onto the coated inner pressure receptacle with adequate adhesion to prevent water ingress between the coating of the pressure receptacle and the over-moulded protective case during the cylinder life. It also provides mechanical protection to the pressure receptacle.

2. The over-moulded case does not allow the detection of small leaks nor to visually check permanent expansion of the inner receptacle during periodic test. Moreover the check of the external conditions of the pressure receptacle is not possible as the steel external surface is not visible. So instead of an individual check of the cylinder for periodic inspection, an alternative way has been developed based on regular sampling and destructive testing. A multilateral agreement (M247) has been signed in 2011 in accordance with this periodic inspection method.

3. This subject has been already discussed during last two joint meetings. The working document which was submitted for last joint meeting (Autumn 2013 session) was issued to answer questions asked during the previous joint meeting (Spring 2013). During last joint meeting, an informal document (INF 50) was issued to incorporate additional comments. It has been recorded in the last Joint Meeting (Autumn 2013) report (section VII. A. 2) that the Joint Meeting had no objection in principle to the texts proposed by AEGPL in INF 50.

4. The purpose of this document is to provide better understanding of the statistical method of periodic inspection by sampling with an example in annex 2 and to provide the latest update of the revision of EN1440 - LPG equipment and accessories, Periodic inspection of transportable refillable LPG cylinders (annex 1).

5. A key change has been made to the last AEGPL proposal (INF.50) to add a general clause (see point 11 below) about periodic inspection of pressure receptacles (so not specific to LPG over-moulded cylinders) with destructive tests, so by sampling:

- in case a check required in RID/ADR clauses 6.2.1.6.1 (a) to (e) cannot be performed for a certain type of design, a non-destructive test (NDT) shall be used,

- and in case no NDT is relevant for this type of design, an approved periodic inspection method based on sampling shall be done.

NOTE: *checks cannot provide sufficient or relevant data if the test does not provide sufficient reliable results on the properties of a design type, or if the test cannot be performed in the intended manner without destruction nor damage of the receptacle, or if the information is not of the intended quality or not safety relevant for the kind of design.*

Proposal

6. Add the following definition in 1.2:

"Over-moulded cylinder, means a cylinder intended for the carriage of LPG of a water capacity not exceeding 13 litres made of a coated steel inner pressure receptacle with an over-moulded protective case made from cellular plastic which is non removable and bonded to the outer surface of the inner receptacle wall".

7. Add in the existing definition of "Pressure receptacle" under 1.2, over-moulded cylinders.

8. Add a new point in (7) in packing instruction P200 in 4.1.4.1:

"(c) The owner shall demonstrate to the satisfaction of the competent authority that the over-moulded cylinders are only filled in filling centres applying a documented quality system and that the requirements of EN1439:2008 are fulfilled and correctly applied. The owner shall provide documentary evidence to the competent authority that the filling centre complies with these requirements.

9. To remove the exclusion of clause 3.5 and of annex G for EN 1439:2008 in the table in point 11 in P200.

10. Add elementary design information in 6.2:

Add a paragraph 6.2.1.1.10 *additional requirement for the construction of over-moulded cylinders*

Over-moulded cylinders shall be produced serially based on steel cylinders in accordance with EN1442, EN14140 or annex I, parts 1 to 3 to Council Directive 84/527/EEC. Each cylinder shall be fitted with an individual resilient identification

electronic tag or an equivalent device linked to an electronic database. The design of the over-moulding case shall prevent water ingress.

11. Add a clause regarding periodic inspection procedure for pressure receptacles: 6.2.3.5.3 ***General specific provisions***

(a) If inherent properties of a design prevent the successful performance of one or more checks required in 6.2.1.6.1 (a) to (e) for periodic inspection or the successful evaluation of its test results, a method of non-destructive-testing proposed in 6.2.1.6.1 shall be chosen instead with approval of the competent authority.

(b) If none of the available methods of non-destructive testing is appropriate as an alternative for the testing of each pressure receptacle for a certain design, a testing method shall be used which enables the surveillance of degradation of groups of pressure receptacles of this design by destructive testing of samples of each group. Each pressure receptacle of such a group shall be marked (e. g. by identification electronic tag) in such a way that it can be easily retraced to its relevant group prior to each pre-fill inspection and periodic inspection.

(c) The testing method is defined by the destructive tests to be performed, the sample size, the statistical assessment of the results, the criteria to be met and the frequency of the tests. In case of evaluation of residual burst or fatigue strength properties, the confidence level of a sample shall be defined by the competent authority or by a periodic inspection standard referenced in 6.2.4, considering the potential consequence of a receptacle failure. The test shall be performed on an adequate sample of receptacles and the periodicity of the tests shall ensure the detection of loss of properties of the receptacle before they may become critical.

(d) If the surveillance of degradation shows insufficient properties, the group is considered to have failed the periodic inspection and shall be taken out of service. A further use of parts of the relevant groups (sub-groups) can be allowed by the competent authority authorizing the original approval if it has been demonstrated without doubt that the cause of the periodic inspection failure is known and not valid for the other parts of the group (sub-groups).

(e) An individual periodic inspection check can only be replaced by a test by sampling for a certain design of receptacle if the testing method is described in 6.2.3.5.

12. Add a clause regarding periodic inspection procedure of over-moulded cylinders: 6.2.3.5.4 ***Specific provisions for over-moulded cylinders***:

(a) In accordance with 6.2.3.5.3, periodic inspection of over-moulded cylinders can be performed by sampling.

(b) A group of over-moulded cylinders is defined as cylinders with the steel inner pressure receptacle manufactured within a calendar year by single manufacturer and over-moulded by a single over-moulding company.

(c) A sample of each group of over-moulded cylinders shall have a minimum size as given in [annex F of prEN1440 (WI00286156)].

(d) The check of the external conditions of over-moulded cylinders in accordance with 6.2.1.6.1 (a) can be performed on the outer surface of the cellular plastic case but not on the outer surface of the inner pressure receptacle. Therefore destructive adhesion tests and peeling tests shall be performed on two samples per group to check that there is no external

corrosion on the inner receptacle wall and the cellular plastic case keeps its adhesive properties with time. A detailed method is specified in [annex F of prEN1440 (WI00286156)].

(e) The hydraulic pressure test in accordance with 6.2.1.6.1 (d) may lead to a crack of the inner receptacle which is not recognizable as leakage. Therefore 6.2.1.6.1 (d) shall be substituted by burst tests on one sample per group. The hydraulic pressure test shall not be used as substitution of the test concept of [annex F of prEN1440 (WI00286156)]. The result of burst tests shall be in accordance with the unilateral statistical tolerance interval of ISO 16269-6:2005 for a confidence level of 95% and a fraction of population equal to 99% as described in [annex F of prEN1440 (WI00286156)].

(f) The frequency of the controls of each production group is after 3 years in service and then every 5 years thereafter.

(g) The test results shall be monitored and kept available by the owner of the over-moulded cylinders for 30 years.

(h) If the burst test or peeling test fails, the tests are re-done considering sub-groups to define the sub-group with a manufacturing defect. The production group or sub-group with defect has to be withdrawn immediately after detection using the electronic tag.

(i) If the result of the adhesion test does not comply with the criteria for at least one test, a second sampling of the same size is made. If at least one result of the second sampling does not comply with the minimum value of the adhesion criteria, tests are re-done considering sub-groups to define the sub-group with a manufacturing defect. The production group or sub-group with the defect has to be withdrawn immediately after detection using the electronic tag.

(j) If during the visual external inspection, the outer surface of an over-moulded cylinder is not free from material gouges, cuts or cracks that may harm the protection against corrosion of the inner steel pressure receptacle as defined in EN1439:2008 annex G, the over-moulding case shall be removed. A reuse of the inner receptacle for over-moulding is permitted.

13. Remove the exclusion of annex G for EN 1440:2008 + A1:2012 in the periodic inspection and test standards table in 6.2.4.2.

Justification

14. In the same way with the pressure test, the burst test can demonstrate that the mechanical and structural integrity of the inner receptacle is maintained.

In the same way with the external check of the pressure receptacle, the adhesion test and the peeling test can show that there is no external corrosion on the inner receptacle wall. The adhesion test demonstrates that the over-moulded case retains its adhesive properties with time and so continues to protect the anti-corrosion coating of the inner receptacle. It has been demonstrated that good adhesion of the over-moulded case means that there is no corrosion on the inner receptacle (external corrosion): see annex 2 of INF for autumn 2013 session. An adhesion test and characteristics of the cellular plastic case have been added in the design standard prEN14140 and prEN1442. The peeling test allows visual external check of the pressure receptacle.

The details of these tests are described in the multilateral agreement M247 and in annex G of EN 1440:2008 + A1:2012 about periodic inspection of over-moulded cylinders. EN1440 is currently under revision and the annex dedicated to over-moulded cylinders will be revised in order to be fully aligned with M247 (see annex 1: Annex F of prEN 1440 (WI 00286156), December 2013 draf).

15. In case of an unsuccessful periodic inspection, the group of cylinders can be easily withdrawn at the filling plant when the cylinders are returned using the electronic tag and database.

16. Regarding the experience, the proposed method has been used since 2000. No issue or lack of efficiency has been found. The burst test method (with the statistical assessment) is used since 1966 for French national LPG cylinders to have a 15 years period for periodic inspection.

Enforcement

17. No difficulties with enforcement are foreseen. A multilateral agreement, M247, has been signed by several countries and is valid until the 31 December 2016.

Annexes:

Annex 1: Annex F of prEN 1440 (WI 00286156), LPG equipment and accessories - Transportable refillable LPG cylinders other than welded and brazed steel cylinders: periodic inspection

Annex 2: Example on application of periodic inspection method

These annexes are reproduced in informal document INF.4.